GDP versus Manufacturing Output: Proof of Movement of Standardized Processes

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ABSTRACT

Since the early 2000's there has been a decline in the share of labor in manufacturing in most developed countries around the world. Using World Bank data sets that include information on rich, middle, and poor nations, we test the theory that as a manufacturing process becomes more standardized and requires less skill to produce, the process is moved to middle income nations. Statistics on wages, infant mortality, education and GDP are used to qualify the economic status of the nation as well as the abilities of the labor force. The evidence collected suggests that manufacturing moves away from countries with very low and very high GDP's and moves toward countries that fall into the developing category.

INTRODUCTION

With the growing importance of trade in manufactured intermediate goods between rich and middle income countries, it is without a doubt that workers in developed nations are becoming increasingly concerned about the impact of offshoring on their domestic labor markets. Although economists have generally supported these developments due to gains from specialization, these gains are also accompanied by growing public anxiety about job security. The concerns of the working-class Americans have been showing through, especially in the 2016 Presidential Elections. In fact, the Trump administration's "America First" goals are to incentivize major manufacturing companies who are shifting production abroad while laying off thousands of American workers to remain domestic. Although incentives are given to firms so they will maintain their production locally, companies like UTC and GE still choose to offshore some of their manufacturing capabilities. Producing in a developing country with standardized manufacturing process has significantly less labor costs and the savings from offshoring often offset the costs of setting up new plants overseas if planned thoroughly.

While this movement may seem alarming this work proposes that it is actually a natural part of a manufacturing process' life cycle that follows a path from conception to design and implementation then finally retirement. At the later point of implementation, the process is standardized and does not require skilled labor to implement. This makes it inefficient for developed countries to continue producing a given good so the work will move to an area with a less skilled labor force since a less skilled labor force is adequate for the process to be completed. First the manufacturing output of a country will be measured against its GDP to see if, as GDP increases, developing countries will have a greater manufacturing output and developed countries will have a lower output. Then more variables will be considered to quantify the work force. With this, in conjunction with economic status, the goal is to observe the effects of the “quality” of the labor force on manufacturing output. The aspiration is to prove that the manufacturing jobs that are seen moving to developing countries are more than likely those that are a tied to standardized manufacturing process.

LITERATURE REVIEWS

Martin Baily and Barry Bosworth (2014) discuss the growth of the US manufacturing sector and comparing its positive growth to the negative growth in the total share of employment in the manufacturing sector. They state growth of real output in the us manufacturing sector has equaled or exceeded the growth of the total GDP of the US but there has been a noticeable decline in the total employment in manufacturing. A large amount of manufacturing growth is contributed to the growth of the computer and electronics industry. They also state that the effect of this growth on overall growth of the manufacturing sector is enormous despite it only making up 10% of US manufacturing. However, some of this industry is moving overseas as innovations within the industry drives the advances in computer services and peripheral equipment that are easily integrated into the US's foreign counterpart’s economies. They link some of the loss of US manufacturing jobs with international trade stating US manufacturing is shifting to buying lower priced input components, including services, from foreign sources. The trade imbalance caused by this shift will lead to shifts in the domestic manufacturing sector as companies seek to expand overseas markets by expanding overseas operations rather than exporting from the domestic market. They go on to point out that as the overseas market expands there is a shift of labor away from the domestic manufacturing sector. However, they prove that this shift of labor from manufacturing employment is not just a US problem but is actually a worldwide phenomenon for high-income economies. They cite data from the OECD that show that the decline that the US has experienced is about the same as the average of the G-7 economies. They express that while US manufacturing sector is still an area of significant technological innovation, with advancements in robotics and additive manufacturing as well as advanced design and materials science, many US corporation still shift their production facilities overseas in order to be competitive. They go on to state some suggestions for retaining manufacturing as a crucial part of US infrastructure by using advanced technologies and public policy.

Gregorio Gimenez, Carmen Lopez-Pueyo and Jaime Sanau (2015) state that there is some debate over the definition of human capital and how to measure its effects on GDP. The proxy of human capital is the basis of determining its importance. They consider the quantitative and qualitative dimensions of human capital to try and elaborate an indicator of human capital. Quantitative studies include metrics like formal education received, the cost of investment such as training in human capital and the wage differences between different education levels. Qualitative studies emphasize difference in training quality and education. The new metric takes into account several metrics that had previously been ignored, such as homogenous hours worked and different education levels across different countries, but there are still certain limitations that they acknowledge. However, they do account for the use of the labor in the market and caution against rigid interpretation of skill shares across different countries. They use their new metric and apply a Granger causality test to prove or disprove the relationship between human capital and GDP. After Augment Dickey-Fuller, Phillips-Perron, and cross-sectionally augmented panel unit root tests (CIPS tests), a Granger test is applied and they prove that GDP causes human capital and human capital causes GDP. They also go on to discuss causality between human capital and innovation but this will not be touched on in this paper.

Peter Leibl, Christiane Nischler, Roger Morefield and Rolf Pfeiffer (2009) state that offshoring has been growing since the 1970's. Many firms rush into moving manufacturing offshore due the appearance of savings from labor and material costs. The author's state that the movement of manufacturing is often done with inadequate analysis or preparation. The main reason for movement of standardized manufacturing processes to developing countries is the savings in labor costs afforded by moving to lower cost countries which they then support using labor cost data for a few different European countries. Another reason, although much smaller in extent, is the geographical abundance of raw materials used for these standardized processes. However, there are potential costs associated with the movement of these manufacturing processes to other countries. These costs would include transporting equipment, training workers in the country to which the process was moved, additional shipping costs to move the product to its destination and the overhead cost of coordinating people with different work cultures, languages, etc. They state an estimate that only 20% of companies that engage in offshoring actually benefit from it and go on to present questions for evaluating the pros and cons of offshoring manufacturing and R&D capabilities. The article concludes by saying that companies can operate profitably in manufacturing and R&D if processes are efficient and costs are carefully monitored. They suggest taking precautions to avoid costly mistakes and in the long run invest in resource mobility between low and high-cost countries.

The work of Gimenez, Lopez-Pueyo, and Sanau (2015) allow us to assume a relationship between the human capital available within in a country and the output of that country as GDP. This output would include metrics from the manufacturing industry, especially those that make up the 90% of the sector that is not computers or electronics. With less innovation coming from sectors not in computer and electronics, a lot of the processes used for manufacturing would become mainstreamed and have standardized processes. It would also mean that skilled labor is no longer keenly required for the process. This allows for those processes to be moved to countries with a lower wage rate and a larger, less skilled labor force since high tech skills are no longer required to produce them. The examples given by Leibl, Nischler, Morefield and Pfeiffer (2009) illustrate that offshoring indeed offers a lucrative opportunity for companies to shift their standardized manufacturing processes to low-cost countries. From data gathered to support our thesis, it is observed that countries that have low labor costs are generally developing or underdeveloped countries. Another important thing to note is that offshoring benefits most impact mass production of products with low complexity, which lend itself to the theory that most offshoring happens in manufacturing of standardized goods. As stated in their paper, Baily and Bosworth (2014) note the decline of the share of employment in manufacturing is a phenomenon experienced by developed nations. This would support the idea that developing countries have more manufacturing output as it moves to them from their developed counterparts.

DATA

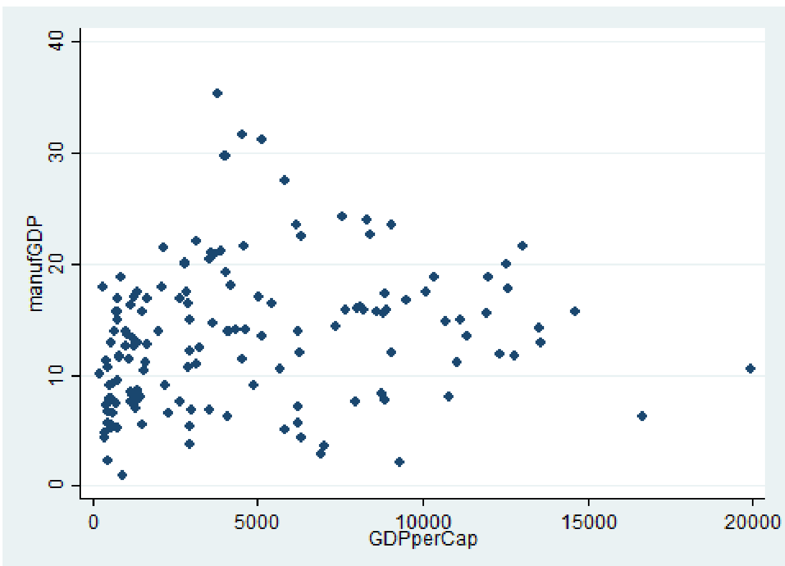
The dependent variable for this study is manufacturing as a percent of GDP since the test is to see if developing countries have a higher manufacturing output than developed countries. The independent variables taken to create the models are the mortality rate of youth 5 and under, personal remittance received, average total years of education, GDP per capita, and government expenditure on education as a percentage of GDP. GNI per capita was also used, not as a metric for the dependent variable but to quantify the cut off points for underdeveloped, developing and developed status. The independent variables were chosen to help quantify the economic status of the country as well as qualify the type of the labor force in each country. The unit of measure that was taken as a standard for these purposes is percentage of GDP and a range of data from 2009 to 2012 was used.

All of the collected data sets were acquired from World Bank except for the average total years of education, which came from Barro-Lee. World Bank and Barro-Lee pull data from countries ranging from Afghanistan to Zimbabwe, encompassing the full spectrum of economic statuses that could classify a country. The year of data decided upon for each variable was 2010 due to the fact that the most recent data for average years of education from Barro-Lee is 2010. This created an insufficient number of observations due to the gaps in each data set. Therefore, for only the variable government expenditure on education, data from 2009 to 2012 was used to fill in the gaps for Bangladesh, Botswana, Fiji, Kazakhstan, The Republic of Korea, Morocco, Maldives, Mozambique, Panama, the Philippines, the Russian Federation, the Ukraine, Uruguay, and Venezuela.

The following are the summary statistics for all variables in low-income countries (GNI per Capita < $12376):

Variable	Obs	Mean	Std. Dev.	Min	Max
manufGDP	151	13.39183	6.371338	.999469	35.22338
GDPperCap	169	4445.629	4016.144	214.231	19920.65
remittReci~d	162	2.20e+10	5.96e+10	0	4.17e+11
yrsEdu	99	7.530909	2.634463	1.88	12.11
govtExpOnEdu	136	4.524306	1.72786	1.20455	12.83727
mortality_~r	169	50.0246	39.78089	4.6	208.8

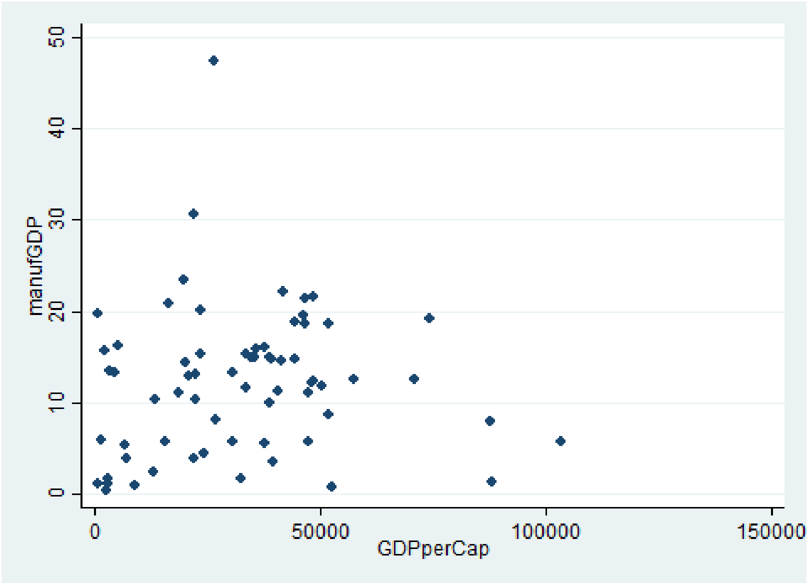
As seen in the table above the number of observations of this will be limited by the average years of education. The graph below shows the correlation between the main independent variable, GDP per capita, with the manufacturing output for all low and middle-income countries. The correlation graphs for the other independent variables can be found in the Appendix (Figures 1 to 4).



The following are the summary statistics for all variables in high-income countries (GNI per Capita > $12,376):

Variable	Obs	Mean	Std. Dev.	Min	Max
manufGDP	68	12.03981	8.051653	.4838291	47.34367
GDPperCap	76	34831.11	28285.67	884.2761	145221.2
remittReci~d	66	1.17e+10	3.19e+10	0	1.32e+11
yrsEdu	45	10.33956	2.193334	3.21	13.18
govtExpOnEdu	55	4.966655	1.778865	.80521	10.48715
mortality_~r	70	17.83635	29.12563	2.4	160.2

As seen in the table above the number of observations of this will be limited by the average years of education as well. The graph below show the correlation between the main independent variable, GDP per capita, with the manufacturing output for all middle-income countries. The correlation graphs for the other independent variables can be found in the Appendix (Figures 5 to 8).



Checking whether the collected data meets the Gauss Markov assumptions, it is first stated that the parameters in the equation in the following section are linear. Second, the data collected is random in a sense -- the values which are missing from the total population (countries' data) were not chosen, so the second Gauss Markov assumption is satisfied. The third assumption is true as it is known from the sample data that the GDP of every country is not the same value. Hence, the total sum of squares of the GDP values is greater than 0. For the fourth Gauss Markov assumption, it cannot be guaranteed that the expectation of the error term is zero. The error that is presented is as close to 0 as possible due to the use of the maximum number of countries for which there is data. Typically, the more data points that is used, the closer the regression model gets to the true equation; therefore, the Multiple Regression Model should correct this. Likewise, for the fifth assumption checking for homoscedasticity, the conditional variance of the error cannot be checked to see if it is constant, but the assumption is made that it is as close as possible for the same reason as the fourth assumption.

RESULTS

Shown here is an overall regression model that includes every variable:

```
. regress manufGDP GDPperCap remittRecieved yrsEdu govtExpOnEdu mortality_5under
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Source	SS	df	MS			
				Number of obs	=	102
				F(5, 96)	=	4.28
Model	618.705544	5	123.741109	Prob > F	=	0.0015
Residual	2773.60658	96	28.8917352	R-squared	=	0.1824
				Adj R-squared	=	0.1398
Total	3392.31213	101	33.5872488	Root MSE	=	5.3751

manufGDP	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
GDPperCap	-.0000462	.0000374	-1.23	0.220	-.0001205	.0000281
remittRecieved	1.39e-10	8.34e-11	1.67	0.098	-2.64e-11	3.05e-10
yrsEdu	.4566433	.3443104	1.33	0.188	-.2268075	1.140094
govtExpOnEdu	-.4463038	.3665873	-1.22	0.226	-1.173974	.2813663
mortality_5under	-.042444	.0272733	-1.56	0.123	-.0965811	.0116931
_cons	14.22977	4.103321	3.47	0.001	6.084738	22.37479

In this particular model, only one variable, remittance received, is significant and only a few of the models are showing the downward trend that was expected. In order to combat this several other models were pursued, each changing data compared to the previous model in "packages". The first model is a simple regression model looking to compare manufacturing output as a percent of GDP against the GDP per capita.

$$\text{ManufGDP} = \beta 0 + \beta 1*\text{GDPperCap} + u$$

The second is a multiple regression model using economic factors. For this model manufacturing output as a percent of GDP is regressed against the GDP per capita and average personal remittance. While personal remittance includes all possible areas of income for a person it is used here as an overestimation of the average wage in each country since wage data was unavailable.

$$\text{ManufGDP} = \beta 0 + \beta 1*\text{GDPperCap} + \beta 2*\text{remittReceived} + u$$

The third model is also multiple regression plus an education data package. This model considers manufacturing output as a percent of GDP against the GDP per capita, average personal remittance, and average years of education achieved.

$$\text{ManufGDP} = \beta 0 + \beta 1*\text{GDPperCap} + \beta 2*\text{remittReceived} + \beta 3*\text{yrsEdu} + \beta 4*\text{govtExpOnEdu} + u$$

The final model is a multiple regression of the economic factor data with an added health data package instead of education. It considers manufacturing output as a percent of GDP against the GDP per capita, average personal remittance, and the mortality rate of children under the age of 5 (per 1000 live births).

$$\text{ManufGDP} = \beta 0 + \beta 1*\text{GDPperCap} + \beta 2*\text{remittReceived} + \beta 3*\text{mortality\_5under} + u$$

In order to test the theory that developing countries will have a higher manufacturing output than developed countries and to see if a root cause of the unexpected trend could be found, each model was broken up by the country's economic status. To do this each model was divided into two parts: the first part containing underdeveloped and developing countries and the second containing developed countries. Table 1 shows the coefficients for all variable used in each model for the countries in the low and middle income bracket. Underneath those numbers are the t-stat and p-stat values, along with their significance level. The 95% confidence interval can be found in the appendix in the STATA output (Figure 9 to 12).

Table 1: Model Coefficients for Low and Middle-income Countries

Variable	Model 1	Model 2	Model 3	Model 4
GDPperCap	0.000295** (2.37) {0.019}	0.000260** (2.12) {0.036}	0.000244 (1.17) {0.245}	-0.000129 (-0.86) {0.389}
remittReceived	-	2.82e-11*** (3.53) {0.001)	1.73e-10* (1.90) {0.061}	2.99e-11*** (3.96) {0.000}
yrsEdu	-	-	0.429 (1.31) {0.193}	-
govtExpOnEdu	-	-	-0.260 (-0.64) {0.523}	-
mortality_5-	-	-	-	-0.0731*** (-4.15) {0.000}
Intercept	12.045*** (15.75) {0.000}	11.837*** (15.21) {0.000}	10.402*** (3.72) {0.000}	16.968*** (11.78) {0.000)
Observation #	151	144	72	144

R^2	0.0363	0.1076	0.1619	0.2052

Significance: 10%*, 5%**, 1%*** ( ) = t-stat {} = p-stat

The model that includes just the economic factors is Model 2 that contains only the economic factors of a country. Both of these variables have a positive slope which would indicate that for low and middle-income countries as all variables increase so does the manufacturing output. Thus far, these trends support the proposed hypothesis. Also, it can be noted that the addition of the education and health factor packages alter the effect of GDP per Capita making it insignificant to the model. Table 2 shows the coefficients for all variable used in each model for the countries in the high-income bracket. Underneath those numbers are the t-stat and p-stat values, along with their significance level. The 95% confidence interval can be found in the appendix in the STATA output (Figure 13 to 16).

Table 2: Model Coefficients for High-income Countries

Variable	Model 1	Model 2	Model 3	Model 4
GDPperCap	0.0000234 (0.52) {0.602}	0.0000233 (0.60) {0.554}	-0.000103 (-1.52) {0.140}	7.73e-07 (0.02) {0.987}
remittReceived	-	4.06e-11 (1.52) {0.134}	2.33e-10 (0.92) {0.360}	2.44e-11 (0.99) {0.327}
yrsEdu	-	-	1.721** (2.69) {0.012}	-
govtExpOnEdu	-	-	0.0920 (0.10) {.918}	-
mortality_5-	-	-	-	-0.155** (-2.40) {0.020}

Intercept	11.443*** (6.51) {0.000}	10.398*** (6.63) {0.000}	-1.914 (-0.28) {0.783}	13.958*** (6.29) {0.000}
Observation #	67	59	32	53
R^2	0.0042	0.0470	0.2582	0.1735

Significance: 10%*, 5%**, 1%*** ( ) = t-stat {} = p-stat

Surprisingly, for high-income countries GDP per capita does not seem to play a significant role in determining the manufacturing output of a country and only variables that are significant in any model are the average years of education and the child mortality rate. In Model 4, which has the most significant parameters, the negative trend that was expected was not found in this portion of the data set. This would indicate that as all variables increase so does the manufacturing output, though at a much smaller rate than the one found in the lower income bracket.

To test for robustness of the variables and models a multicollinearity test and an F-stat test were used. Below is the correlation table to test for multicollinearity:

	GDPper~p	remitt~d	yrsEdu	govtEx~u	mortal~r
GDPperCap	1.0000				
remittReci~d	-0.0388	1.0000			
yrsEdu	0.5520	0.0487	1.0000		
govtExpOnEdu	0.0448	-0.0658	0.2554	1.0000	
mortality_~r	-0.4642	0.0268	-0.7664	-0.2839	1.0000

Since none of the variables have a coefficient of 1 or -1, it can be concluded that there is no multicollinearity among any of the variables used to make the models. However, it can be noted that there is a high correlation value when comparing average years of education and child mortality rate.

Next an F-stat test was used, restricting the models according to two packages that were used earlier to assemble the models: (1) GDPperCap and remittReceived and (2) yrsEdu and govtExpOnEdu. Health data is also a package but it has only one data set in it so an F-test cannot be performed. Since only these two sets of data will be used the unrestricted model that the R-squared value will be compared to is Model 3, which includes both of these sets. First the R-squared values for the restricted model for package (1) and (2) must be obtained. They are shown in the table below:

Table 3: Package R-Squared Values

Income Level	Package (1) = 0	Package (2) = 0,
Low and Middle	0.1320	0.1076
High	0.1745	0.0470

Using the R-squared values of 0.1619 for low and middle-income, the F value for a model restricted by package (1) and a model restricted for packaged (2) can be found. The calculated F values are 1.195 and 2.170, respectively. Both of these are lower than the critical value of 3.15. This means that, for countries with a GNI per capita under $12,376, GDP per capita and personal remittance received as well as average years of education and government expenditure on education are not jointly significant for Model 3. Due to this and the results of the p-stats for these four variables it can be concluded that all variables have a high possibility of not being significantly different from zero. Therefore, for low and middle-income countries, Model 3 is a poor model and should be removed.

Using the R-squared value of 0.2582 for high-income, the calculated F values are 1.523 for package (1) and 3.844 for package (2). The first of these is lower than the critical value of 3.35 and the second is not. This means that, for countries with a GNI per capita above $12,376, GDP per capita and personal remittance received are not jointly significant in Model 3 but average years of education and government expenditure on education are jointly significant. Due to this and the results of the p-stats for the first two variables it can be concluded that they have a high possibility of not being significantly different from zero. However, the third and fourth variables since they have a joint significance they can be used together or combined into a single variable for the model. Therefore, for high-income countries, Model 3 is a poor model and should be reevaluated.

Conclusions

Manufacturing, in recent years, is experiencing a shift that sees jobs moving out of developed countries and into developing ones. The idea is that as a manufacturing process becomes mature less skill is required to manufacture it, making it a standardized process. The processes are then moved to a different country to take advantage of a lower labor cost and more abundant natural resources will jobs such as research and development stay in the home country. This set out to prove that the manufacturing we are seeing shift is indeed work tied to standardized processes since it is moving from a developed country to a developing country. Several literary sources were reviewed in order to discover what work has already been done on the subject as well as which variables should be considered for making models. Bailey and Bosworth (2014) made the observation that the shift in manufacturing was a phenomenon that was experience in most developed nations, sighting example in the G7. Labor cost numbers ran by Peter Leibl, Christiane Nischler, Roger Morefield and Rolf Pfeiffer (2009) showed that there was an advantage to the mobility of processes. Gimenez, Lopez-Pueyo, and Sanau (2014) also state that there is a relationship between the human capital available within in a country and the country's GDP. From these three sources the variables for the model were narrowed down to variables that could describe GDP, wages, the education of the labor force, and the qualitative aspects of the labor force. World Bank as well as Barro-Lee were used to obtain the data the resulted in the five variables used in the models: 1) GDP per capita, 2) personal remittance received used in this case as on overestimation of the wage, 3) average years of education, 4) government expenditure on education, and 5) child (5 and under) mortality rate per 1,000 live births.

The data was divided into two sectors, one for the low and middle income countries and one for the high-income countries. The cutoff for this was determined by GNI per capita since World Bank defines a high-income country as a country with a GNI per capita of $12,376 or greater. Several models were then tested including a simple regression and a few multiple regressions. For low and middle income countries, the only model that was found to be completely significant was the model comparing manufacturing output against the GDP per capita and personal remittance. For high income countries, no model was found to be completely significant. Both sector displayed a positive trend when comparing a majority of the variables to the manufacturing output. For the lower sector this would support the hypothesis, however, for the higher sector the hypothesis breaks down. This could be due to the fact that, while the manufacturing is indeed losing a quantity of the labor force and the high-volume-low-price market, the part of the manufacturing market that is low-volume-high-cost remains in the home country. This could be enough to create a positive trend when compared to things such as GDP, wage, and education but it would not be anywhere near the rate of a developing country.

Moving forward several changes would be made variables. The rate of growth of manufacturing output would be considered to replace manufacturing output as a percent of GDP while other variable, such as government expenditure on education, would be dropped due to its insignificance. More variables to consider adding would be manufacturing employment levels as a percent of the overall labor market, the manufacturing output per industry, and the amount of research and development done in a country. The hope here would be to prove that the growth rate of manufacturing would increase as several factors increased to a certain level and then would begin to fall when it reached the cut off for low and middle-income countries.

References

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Appendix

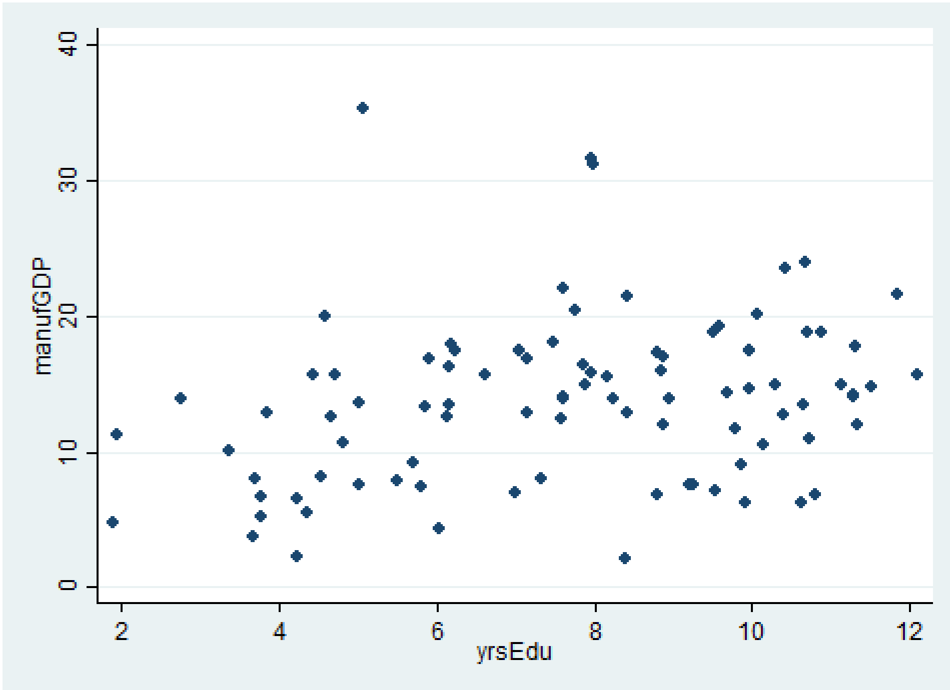

Figure 1 – Low and middle-income yrsEdu vs ManufGDP

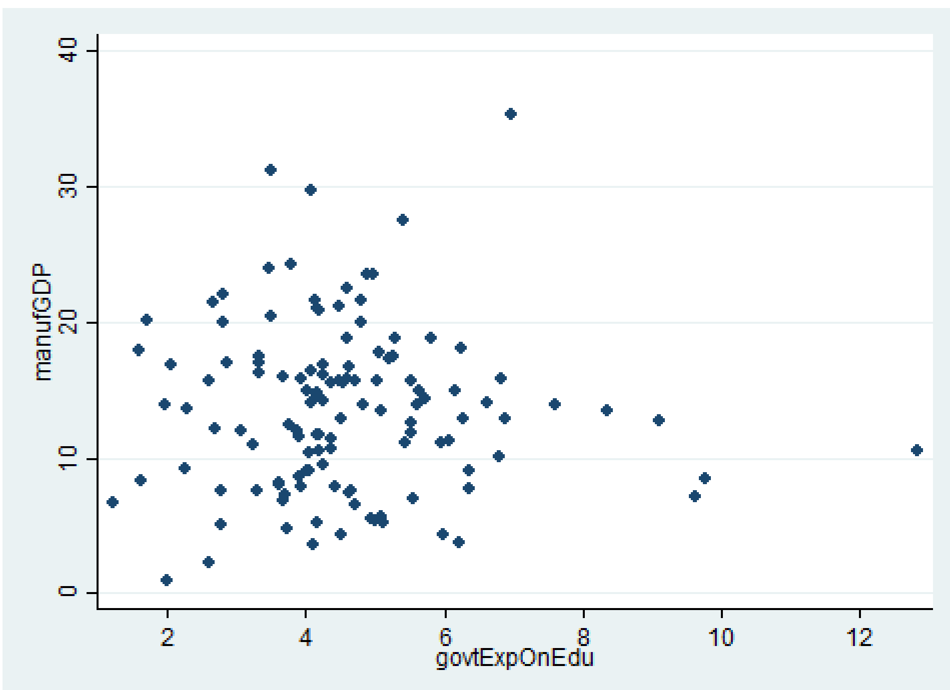

Figure 2 – Low and middle-income govtExpOnEdu vs ManufGDP

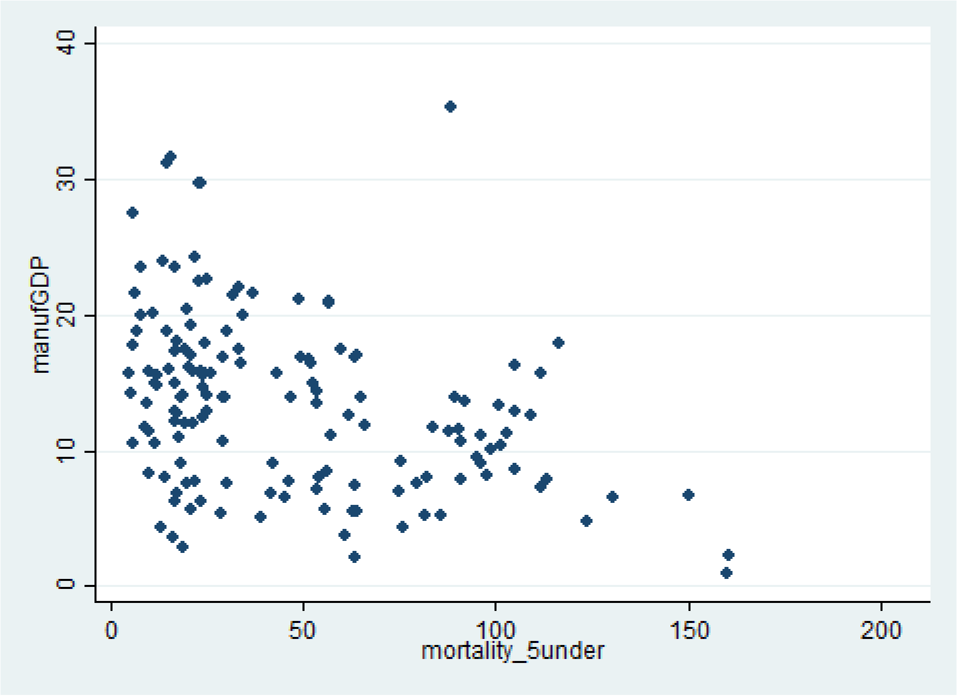

Figure 3 – Low and middle-income mortality_5- vs ManufGDP

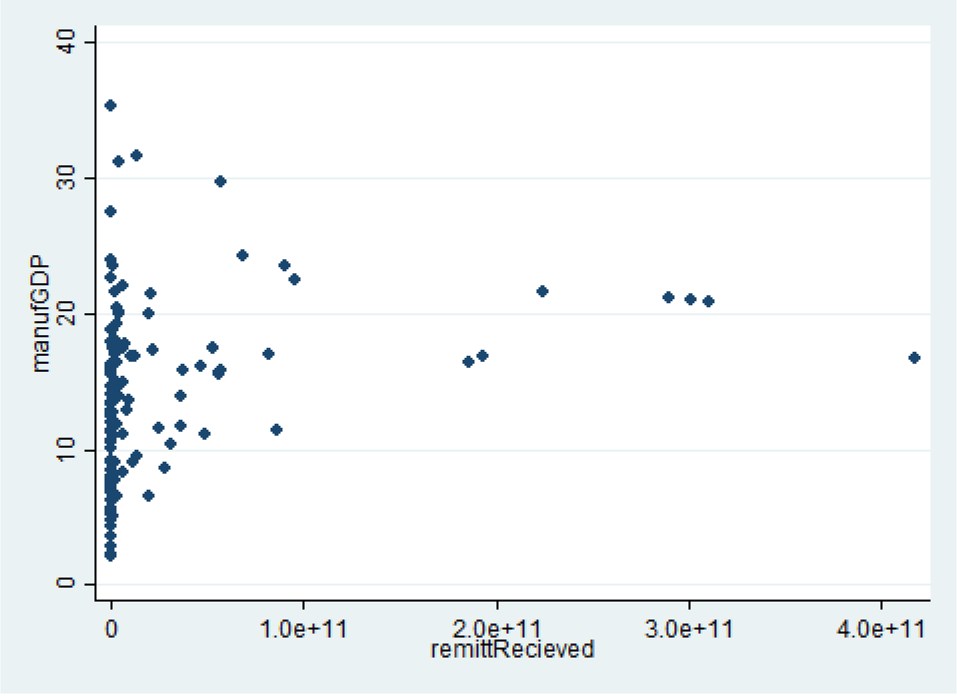

Figure 4 – Low and middle-income remittRecieved vs ManufGDP

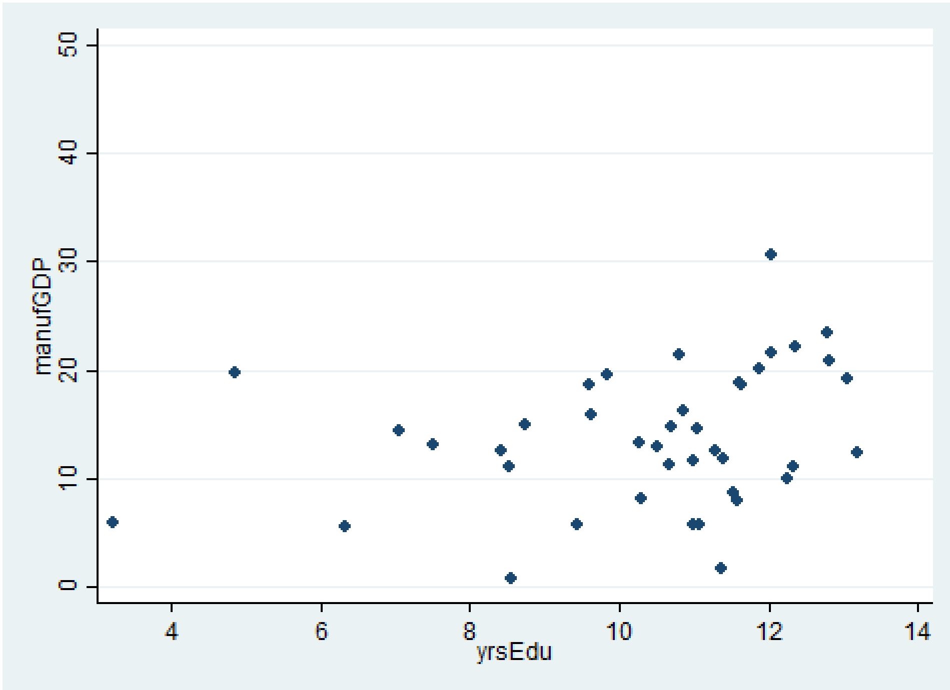

Figure 5 - High-income yrsEdu vs ManufGDP

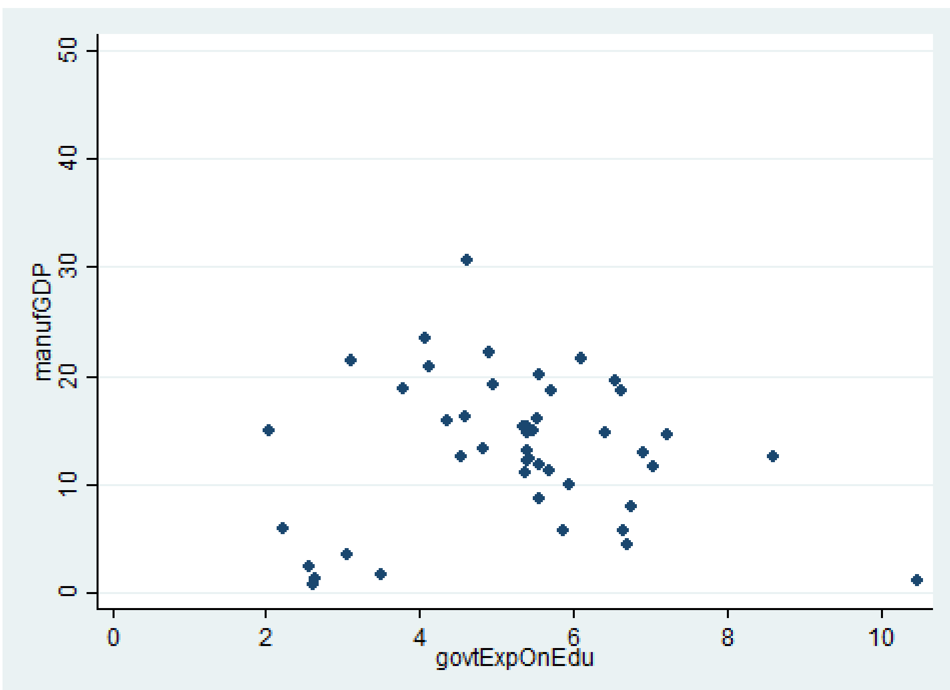

Figure 6 - High-income govtExpOnEdu vs ManufGDP

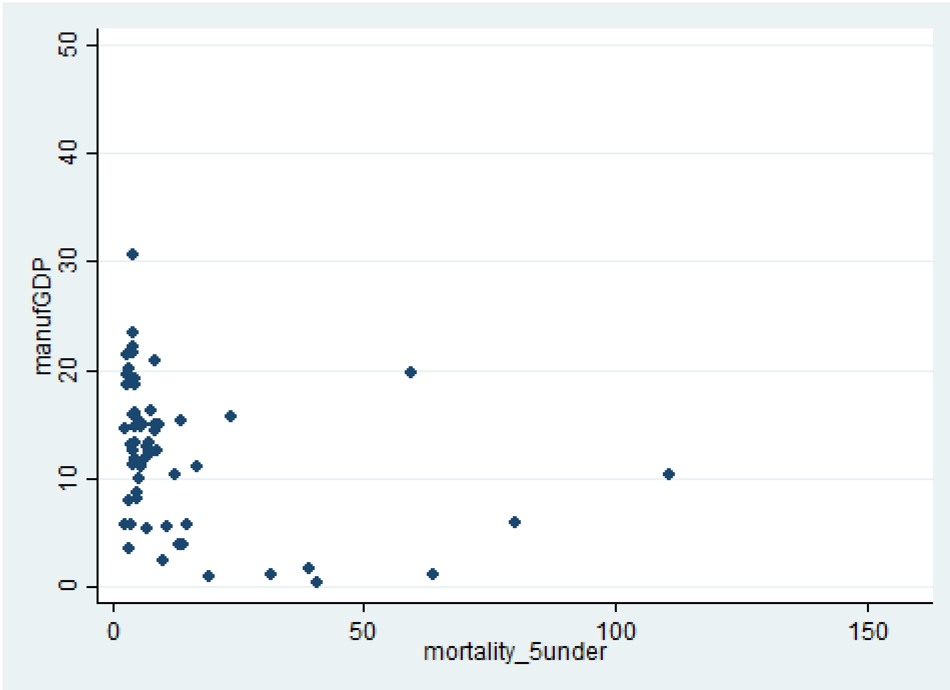

Figure 7 - High-income mortality_5- vs ManufGDP

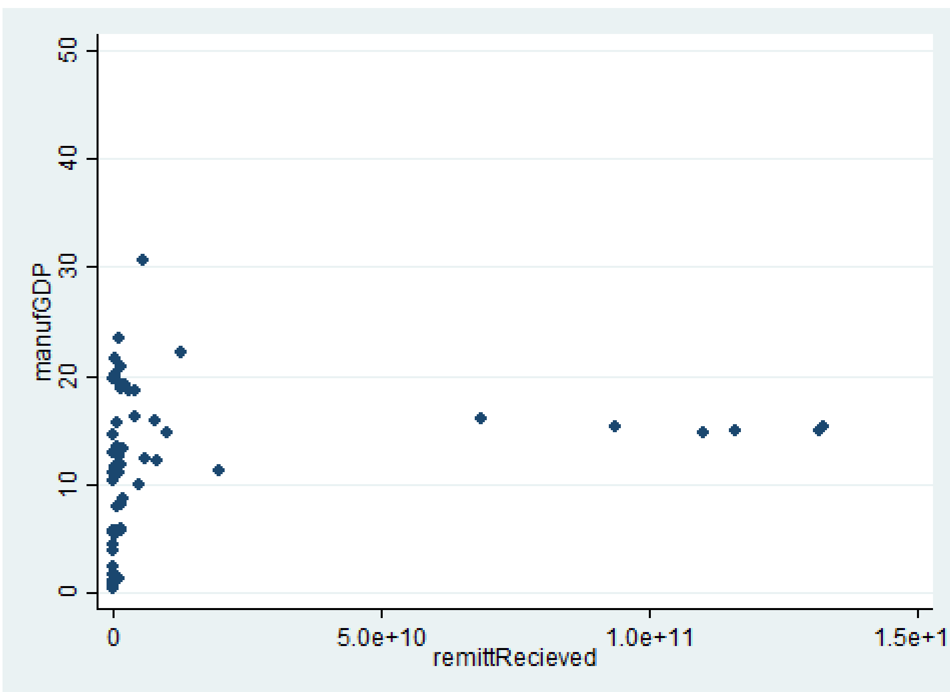

Figure 8 - High-income remittRecieved vs ManufGDP

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. regress manufGDP GDPperCap if GNIperCap < 12475
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Source	SS	df	MS			
Model	220.760772	1	220.760772	Number of obs	=	151
Residual	5868.33055	149	39.3847688	F(1, 149)	=	5.61
				Prob > F	=	0.0192
Total	6089.09132	150	40.5939421	R-squared	=	0.0363
				Adj R-squared	=	0.0298
				Root MSE	=	6.2757

manufGDP	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
GDPperCap	.0002954	.0001248	2.37	0.019	.0000489	.000542
_cons	12.04482	.7645453	15.75	0.000	10.53407	13.55557

Figure 9 – Model 1, Simple Regression Low and middle-income

Source	SS	df	MS			
Model	611.847893	2	305.923946	Number of obs	=	144
Residual	5073.62017	141	35.9831218	F(2, 141)	=	8.50
				Prob > F	=	0.0003
Total	5685.46806	143	39.7585179	R-squared	=	0.1076
				Adj R-squared	=	0.0950
				Root MSE	=	5.9986

manufGDP	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
GDPperCap	.0002595	.0001225	2.12	0.036	.0000174	.0005016
remittRecieved	2.82e-11	7.99e-12	3.53	0.001	1.24e-11	4.40e-11
_cons	11.83672	.7781274	15.21	0.000	10.29841	13.37502

Figure 10 – Model 2, MLR 1 Low and middle-income

```
. regress manufGDP GDPperCap remittRecieved yrsEdu govtExpOnEdu if GNIperCap < 12475

      Source |       SS           df       MS      Number of obs   =        72
-------------+----------------------------------   F(4, 67)        =      3.24
       Model |  385.875859         4  96.4689649   Prob > F        =    0.0173
    Residual |    1997.891        67  29.8192687   R-squared       =    0.1619
-------------+----------------------------------   Adj R-squared   =    0.1118
       Total |  2383.76686        71  33.5741812   Root MSE        =    5.4607

------------------------------------------------------------------------------
    manufGDP |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   GDPperCap |   .0002441   .0002083     1.17   0.245    -.0001717    .0006599
remittRecieved |   1.73e-10   9.08e-11     1.90   0.061    -8.52e-12    3.54e-10
      yrsEdu |   .4293623   .3265627     1.31   0.193    -.2224596    1.081184
govtExpOnEdu |   -.260041   .4053693    -0.64   0.523    -1.069162    .5490795
       _cons |   10.40154   2.799022     3.72   0.000     4.814664    15.98841
------------------------------------------------------------------------------
```

Figure 11 – Model 3, MLR 2 Low and middle-income

```
. regress manufGDP GDPperCap remittRecieved mortality_5under if GNIperCap < 12475

      Source |       SS           df       MS      Number of obs   =       144
-------------+----------------------------------   F(3, 140)       =     12.05
       Model |  1166.85375         3  388.951249   Prob > F        =    0.0000
    Residual |  4518.61431       140  32.2758165   R-squared       =    0.2052
-------------+----------------------------------   Adj R-squared   =    0.1882
       Total |  5685.46806       143  39.7585179   Root MSE        =    5.6812

------------------------------------------------------------------------------
    manufGDP |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   GDPperCap |  -.0001287   .0001491    -0.86   0.389    -.0004234     .000166
remittRecieved |   2.99e-11   7.58e-12     3.95   0.000     1.50e-11    4.49e-11
mortality_5under |  -.0731456   .0176392    -4.15   0.000    -.1080192   -.038272
       _cons |   16.96843   1.440331    11.78   0.000     14.12081    19.81604
------------------------------------------------------------------------------
```

Figure 12 – Model 4, MLR 3 Low and middle-income

```
. regress manufGDP GDPperCap if GNIperCap > 12475
```

Source	SS	df	MS
Model	17.7287297	1	17.7287297
Residual	4199.36047	65	64.6055457
Total	4217.0892	66	63.8952909

Number of obs	=	67
F(1, 65)	=	0.27
Prob > F	=	0.6022
R-squared	=	0.0042
Adj R-squared	=	-0.0111
Root MSE	=	8.0378

manufGDP	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
GDPperCap	.0000234	.0000447	0.52	0.602	-.0000658	.0001126
_cons	11.44337	1.756701	6.51	0.000	7.934997	14.95175

Figure 13 – Model 1, Simple Regression High-income

```
. regress manufGDP GDPperCap remittRecieved if GNIperCap > 12475
```

Source	SS	df	MS
Model	128.130582	2	64.0652909
Residual	2597.48084	56	46.3835864
Total	2725.61142	58	46.9933004

Number of obs	=	59
F(2, 56)	=	1.38
Prob > F	=	0.2597
R-squared	=	0.0470
Adj R-squared	=	0.0130
Root MSE	=	6.8105

manufGDP	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
GDPperCap	.0000233	.0000392	0.60	0.554	-.0000552	.0001019
remittRecieved	4.06e-11	2.68e-11	1.52	0.134	-1.30e-11	9.42e-11
_cons	10.39814	1.568529	6.63	0.000	7.255997	13.54028

Figure 14 – Model 2, MLR 1 High-income

```
. regress manufGDP GDPperCap remittRecieved yrsEdu govtExpOnEdu if GNIperCap > 12475
```

Source	SS	df	MS			
Model	347.564164	4	86.8910411	Number of obs	=	32
Residual	998.405236	27	36.9779717	F(4, 27)	=	2.35
				Prob > F	=	0.0795
Total	1345.9694	31	43.4183677	R-squared	=	0.2582
				Adj R-squared	=	0.1483
				Root MSE	=	6.081

manufGDP	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
GDPperCap	-.0001029	.0000677	-1.52	0.140	-.0002418	.000036
remittRecieved	2.33e-10	2.54e-10	0.92	0.368	-2.88e-10	7.54e-10
yrsEdu	1.721321	.6396997	2.69	0.012	.4087652	3.033876
govtExpOnEdu	.09195	.8812292	0.10	0.918	-1.716183	1.900083
_cons	-1.914301	6.871524	-0.28	0.783	-16.0135	12.1849

Figure 15 – Model 3, MLR 2 High-income

```
. regress manufGDP GDPperCap remittRecieved mortality_5under if GNIperCap > 12475
```

Source	SS	df	MS			
Model	395.793485	3	131.931162	Number of obs	=	53
Residual	1885.08793	49	38.4711822	F(3, 49)	=	3.43
				Prob > F	=	0.0241
Total	2280.88141	52	43.8631041	R-squared	=	0.1735
				Adj R-squared	=	0.1229
				Root MSE	=	6.2025

manufGDP	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
GDPperCap	7.73e-07	.0000471	0.02	0.987	-.0000938	.0000954
remittRecieved	2.44e-11	2.47e-11	0.99	0.327	-2.52e-11	7.41e-11
mortality_5under	-.1546357	.0643783	-2.40	0.020	-.2840088	-.0252626
_cons	13.95812	2.219364	6.29	0.000	9.498146	18.4181

Figure 16 – Model 4, MLR 3 High-income